

What is claimed is:

1. A heat transfer system for a cyclical heat exchange system, the heat transfer system comprising:

an evaporator including a wall configured to be coupled to a portion of the cyclical
5 heat exchange system and a primary wick coupled to the wall; and
a condenser coupled to the evaporator to form a closed loop that houses a working fluid.

2. The heat transfer system of claim 1 wherein the condenser includes a vapor
10 inlet and a liquid outlet;

further comprising:

a vapor line providing fluid communication between the vapor outlet and the vapor
inlet; and

a liquid return line providing fluid communication between the liquid outlet and the
15 liquid inlet.

3. The heat transfer system of claim 2 wherein the evaporator includes:

a liquid barrier wall containing the working fluid on an inner side of the liquid barrier
wall, which working fluid flows only along the inner side of the liquid barrier wall, wherein
20 the primary wick is positioned between the heated wall and the inner side of the liquid barrier wall;

a vapor removal channel that is located at an interface between the primary wick and
the heated wall, the vapor removal channel extending to a vapor outlet; and

a liquid flow channel located between the liquid barrier wall and the primary wick,
25 the liquid flow channel receiving liquid from a liquid inlet.

4. The heat transfer system of claim 1 wherein the working fluid is moved
through the heat transfer system passively.

5. The heat transfer system of claim 4 wherein the working fluid is moved
30 through the heat transfer system without the use of external pumping.

6. The heat transfer system of claim 1 wherein the working fluid within the heat transfer system changes between a liquid and a vapor as the working fluid passes through or within one or more of the evaporator, the condenser, the vapor line, and the liquid return line.

5 7. The heat transfer system of claim 1 wherein the working fluid is moved through the heat transfer system passively.

8. The heat transfer system of claim 1 wherein the working fluid is moved through the heat transfer system with the use of the wick.

10 9. The heat transfer system of claim 1 further comprising fins thermally coupled to the condenser to reject heat to an ambient environment.

15 10. A thermodynamic system comprising:
a cyclical heat exchange system; and
a heat transfer system coupled to the cyclical heat exchange system to cool a portion of the cyclical heat exchange system, the heat transfer system comprising:
an evaporator including a wall configured to be coupled to a portion of the
20 cyclical heat exchange system and a primary wick coupled to the wall; and
a condenser coupled to the evaporator to form a closed loop that houses a working fluid.

25 11. The thermodynamic system of claim 10 wherein the evaporator is integral with the cyclical heat exchange system.

12. The thermodynamic system of claim 10 wherein the evaporator is thermally coupled to the portion of the cyclical heat exchange system.

30 13. The thermodynamic system of claim 10 wherein the cyclical heat exchange system includes a Stirling heat exchange system.

14. The thermodynamic system of claim 10 wherein the cyclical heat exchange system includes a refrigeration system.

5 15. The thermodynamic system of claim 10 wherein the heat transfer system is coupled to a hot side of the cyclical heat exchange system.

16. The thermodynamic system of claim 10 wherein the heat transfer system is coupled to a cold side of the cyclical heat exchange system.

10 17. A method utilizing the systems recited by claims 1-16.